FutureGen

Integrated Sequestration and Hydrogen Research Initiative

Energy Independence through Carbon Sequestration and Hydrogen from Coal

FutureGen is an *Integrated Sequestration and Hydrogen Research Initiative.* The project is a $1 billion dollar government / industry partnership to design, build and operate a zero emissions, coal fired, electricity *and* hydrogen producing power plant. The 275 megawatt prototype plant will serve as a large scale engineering laboratory for testing new clean power, carbon capture and coal-to-hydrogen technologies. It will be the cleanest fossil fuel fired power plant in the world.

Responding to the President's Initiatives

The FutureGen initiative is a direct response to the President's Climate Change and Hydrogen Fuels Initiatives. President Bush emphasized the importance of technology in stabilizing greenhouse gas concentrations in the atmosphere with two major policy announcements: The National Climate Change Technology Initiative on June 11, 2001; and, the Global climate Change Initiative on February 14, 2002. Carbon capture and sequestration technologies likely will be essential to meeting the President's goals. Without them, it will be virtually impossible to limit global carbon emissions.

> *"Technology offers great promise to significantly reduce greenhouse gas emissions, especially carbon capture, storage, and sequestration technologies."*
>
> President George W. Bush
> Announcing the National Climate
> Change Technology Initiative
> June 11, 2001

The President's Hydrogen Fuels Initiative, announced on January 28, 2003, envisions the ultimate transformation of the nation's transportation fleet from a reliance on petroleum to the use of clean-burning hydrogen. Today, most hydrogen in the United States – and about half of the world's hydrogen supply – is produced from natural gas. The new technologies to be integrated into the prototype plant will expand the options for producing hydrogen from coal, providing a more diversified and secure source of feedstocks for the President's Initiative.

The Technology

Cutting edge technologies will be employed in the FutureGen prototype. Rather than using traditional coal combustion technology, the plant will be based on coal gasification which produces a synthesis gas – in which the goal's carbon is converted to a 'synthesis gas' made up primarily of hydrogen and carbon monoxide.

Advanced technology will be used to react the synthesis gas with steam to produce additional hydrogen and a concentrated stream of CO_2. Initially, the hydrogen will be used as a clean fuel for electric power generation either in turbines, fuel cells or hybrid combinations of these technologies. The hydrogen could also be supplied as a feedstock for refineries. In the future, as hydrogen-powered automobiles and trucks are developed as part of President Bush's Hydrogen Fuels Initiative, the plant could be a source of transportation grade hydrogen fuel.

The captured CO_2 will be separated from the hydrogen – perhaps by novel membranes, or other techniques, currently under development. It would then be liquefied and permanently sequestered in a geologic formation. Candidate reservoir(s) could include depleted oil and gas reservoirs, unmineable coal seams, deep saline aquifers, and basalt formations – all common in the United States. The reservoir(s) will be extensively monitored to verify the stability and permanence of CO_2 storage.

Goals

- Design, construct and operate a nominal 275 megawatt prototype plant that produces *both* electricity *and* hydrogen with essentially zero emissions. The size of the plant is driven by the need for producing commercially relevant data, including the requirement for producing one million metric tons per year of CO_2, to adequately validate the integrated operation of the gasification plant and the receiving geologic formation.
- Sequester at least 90 percent of CO_2 emissions from the plant – with future potential to capture and sequester nearly 100 percent.
- Prove the effectiveness, safety and permanence of CO_2 sequestration.
- Establish standardized technologies and protocols for CO_2 measuring, monitoring and verifying.
- Validate the engineering, economic and environmental viability of advanced, coal based, near-zero emissions technologies that by 2020 will: (1) produce electricity with less than a 10 percent increase in cost compared to a non-sequestered system; and, (2) produce hydrogen at $4.00 per million Btu (wholesale), equivalent to $0.48 per gallon of gasoline.

Project Timeline, Components and Estimated Costs